

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Previously presented) A cooling device for an electronic equipment, comprising:

a cooling panel including a bottom heat radiation plate and a top heat radiation plate, at least one of which is provided with a groove, said bottom heat radiation plate and top heat radiation plate being bonded together to form a passage of refrigerant; and

a circulation pump fixed onto said cooling panel to circulate said refrigerant through said passage for radiating heat transferred to said cooling panel, wherein:

said top heat radiation plate is provide with an inlet port through which said refrigerant flows from said passage to said circulation pump and an outlet port through which said refrigerant flows from said circulation pump to said passage; and

said circulation pump is fixed onto said inlet port and outlet port;

wherein said circulation pump is a piezoelectric pump, and

wherein said piezoelectric pump includes a pump housing defining a pump chamber receiving therein a piezoelectric vibration plate, and said pump housing is fixed onto said cooling panel so that a discharge port and a suction port of said circulation pump are aligned with said inlet port and said outlet port, respectively.

2. (Cancelled)

3. (Cancelled)

4. (Previously presented) The cooling device for an electronic equipment according to claim 1, wherein a check valve is provided in operative relationship with each of said discharge port and said suction port, and said check valve is fixed onto a member which is detachably attached onto said pump housing.

5. (Previously presented) The cooling device for an electronic equipment according to claim 1, wherein said piezoelectric vibration plate has a bimorph structure including an elastic circular plate and a pair of piezoelectric ceramic circular plates sandwiching therebetween said elastic circular plate and polarized in opposite directions to each another, each of said pair of piezoelectric ceramic circular plates has a layered structure including a plurality of ceramic layers, and adjacent two of said ceramic layers in said layered structure are polarized in opposite directions to each other.

6. (Previously presented) A cooling device for an electronic equipment comprising:

a cooling panel including a bottom heat radiation plate and a top heat radiation plate, at least one of which is provided with a groove, said bottom heat radiation plate and top heat radiation plate being bonded together to form a passage of refrigerant; and

a circulation pump fixed onto said cooling panel to circulate said refrigerant through said passage for radiating heat transferred to said cooling panel, wherein:

said top heat radiation plate is provide with an inlet port through which said refrigerant flows from said passage to said circulation pump and an outlet port through which said refrigerant flows from said circulation pump to said passage; and

said circulation pump is fixed onto said inlet port and outlet port;

wherein said piezoelectric vibration plate includes a pair of first piezoelectric ceramic elements not polarized, a pair of second piezoelectric ceramic elements sandwiching therebetween said first piezoelectric ceramic elements and polarized in opposite directions to each other, and a pair of third piezoelectric ceramic elements disposed outside said second piezoelectric ceramic elements and not polarized, and wherein each of said second piezoelectric ceramic elements has a layered structure including a plurality of ceramic layers, adjacent two of said ceramic layers in said layered structure are polarized in opposite direction to each other, and said first through third piezoelectric ceramic elements are sintered to form an integral structure.

7. (Previously Presented) The cooling device for an electronic equipment according to claim 1, wherein a reinforcement is formed in said groove for reinforcing bonding of said bottom heat radiation plate and said bottom heat radiation plate.

8. (Previously Presented) The cooling device for an electronic equipment according to claim 1, further comprising a reservoir communicated with a branch hole and fixed onto said top heat radiation plate of said cooling panel and formed in said passage.

9. (Previously Presented) The cooling device for an electronic equipment according to claim 8, wherein a taper of a circular truncated cone or truncated pyramid having an apex at an exit of said branch hole is formed on a bottom surface of said reservoir.

10. (Previously Presented) The cooling device for an electronic equipment according to claim 9, wherein a volume of said reservoir below said apex of said taper is larger than a volume of said reservoir above said apex of said taper (41), and said refrigerant fills said reservoir so that a liquid level is located above said apex of said taper.

11. (Previously Presented) The cooling device for an electronic equipment according to claim 9, wherein a protrusion having an area smaller than a cross-sectional area of said branch hole is formed on top of said reservoir at a position opposing said branch hole.

12. (Previously Presented) The cooling device for an electronic equipment according to claim 1, wherein a portion of said passage is replaced by a micro-channel structure including a plurality of narrow grooves having a width smaller than a width of said groove.

13. (Previously Presented) The cooling device for an electronic equipment according to claim 12, wherein a guide plate is formed between said passage and said micro-channel structure for enlarging flow of said refrigerant from a width of said passage up to a width of said micro-channel structure.

14. (Previously Presented) The cooling device for an electronic equipment according to claim 13, wherein said guide plate includes a plurality of guide plates, and wherein one of said guide plates is longer than another of said guide plates located at downstream of said one of said guide plates, and has a larger angle with respect to a flow direction of said refrigerant than said another.

15. (Previously Presented) The cooling device for an electronic equipment according to claim 1, wherein said passage is coated with metal.

16. (Currently Amended) A cooling device for an electronic equipment, comprising a substrate, a passage embedded in said substrate and passing therethrough refrigerant, a circulation pump disposed on a surface of said substrate, and a reservoir communicated with said first passage via a branch hole, wherein said circulation pump circulates said refrigerant through said passage to radiate heat transferred to said substrate, ~~wherein said reservoir is laid-down-type reservoir fixed onto said surface of said substrate.~~

wherein said circulation pump is a piezoelectric pump, and

wherein said piezoelectric pump includes a pump housing defining a pump chamber receiving therein a piezoelectric vibration plate, and said pump housing is fixed onto said substrate so that a discharge port and a suction port of said circulation pump are aligned with said passage, respectively.

17. (Cancelled)

18. (Currently Amended) A cooling device for an electronic equipment comprising a substrate, a passage embedded in said substrate and passing therethrough refrigerant, a circulation pump disposed on a surface of said substrate, and a reservoir communicated with said first passage via a branch hole, wherein said circulation pump circulates said refrigerant through said passage to radiate heat transferred to said substrate, wherein said reservoir is a standing-rest-type reservoir installed within said substrate[[]],

wherein said circulation pump is a piezoelectric pump, and

wherein said piezoelectric pump includes a pump housing defining a pump chamber receiving therein a piezoelectric vibration plate, and said pump housing is fixed onto said substrate so that a discharge port and a suction port of said circulation pump are aligned with said passage, respectively.

19. (Currently Amended) An electronic equipment having mounting thereon a cooling device for an electronic equipment, the cooling device comprising:

a cooling panel including a bottom heat radiation plate and a top heat radiation plate, at least one of which is provided with a groove, said bottom heat radiation plate and top heat radiation plate being bonded together to form a passage of refrigerant; and

a circulation pump fixed onto said cooling panel to circulate said refrigerant through said passage for radiating heat transferred to said cooling panel, wherein:

said top heat radiation plate is provide with an inlet port through which said refrigerant flows from said passage to said circulation pump and an outlet port through which said refrigerant flows from said circulation pump to said passage; and

said circulation pump is fixed onto said inlet port and outlet port[[]],

wherein said circulation pump is a piezoelectric pump, and

wherein said piezoelectric pump includes a pump housing defining a pump chamber receiving therein a piezoelectric vibration plate, and said pump housing is fixed onto said cooling panel so that a discharge port and a suction port of said circulation pump are aligned with said inlet port and said outlet port, respectively.

20. (New) The cooling device for electronic equipment according to claim 16, wherein said reservoir is a laid-down-type reservoir fixed onto said surface of said substrate.